

CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:

5 providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks, said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic;

providing a substrate having at least one grating structure formed thereabove, said formed grating structure comprised of a plurality of gate stacks;

illuminating said at least one grating structure formed above said substrate;

measuring light reflected off of said at least one grating structure formed above said substrate to generate an optical characteristic trace for said formed grating structure; and

comparing said generated optical characteristic trace to said target trace.

2. The method of claim 1, wherein providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks, said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic, comprises:

generating a plurality of optical characteristic traces for a plurality of grating structures comprised of a plurality of gate stacks;

generating electrical test data for at least one semiconductor device; and

correlating at least one of said plurality of optical characteristic traces with said electrical test data to determine a target optical characteristic trace that

corresponds to a semiconductor device having at least one desired electrical performance characteristic.

3. The method of claim 1, further comprising adjusting at least one parameter of  
5 at least one process used to form gate stack on a subsequently processed wafer based upon said comparison of said generated trace and said target trace.

4. The method of claim 1, further comprising adjusting at least one parameter of  
at least one process operation to be performed on said provided substrate based upon a deviation between said generated trace and said target trace.

5. The method of claim 1, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having at least one  
grating structure formed in a scribe line of said substrate.

6. The method of claim 1, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having at least one  
grating structure formed in a production die formed above said substrate.

20 7. The method of claim 1, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having a plurality of  
grating structures formed thereabove.

25 8. The method of claim 1, wherein said grating structure formed above said  
provided substrate is formed in an area having dimensions of approximately  $100 \times 120 \mu\text{m}$ .

9. The method of claim 1, wherein said at least one desired electrical performance characteristic comprises at least one of a drive current and an operating frequency.

5 10. A method, comprising:

providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks, said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic;

providing a silicon substrate having at least one grating structure formed thereabove, said formed grating structure comprised of a plurality of gate stacks;

illuminating said at least one grating structure formed above said substrate;

measuring light reflected off of said at least one grating structure formed above said substrate to generate an optical characteristic trace for said formed grating structure;

comparing said generated optical characteristic trace to said target trace; and

adjusting at least one parameter of at least one process used to form a gate stack on a subsequently processed wafer based upon said comparison of said generated trace and said target trace.

20 11. The method of claim 10, wherein providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks, said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic, comprises:

generating a plurality of optical characteristic traces for a plurality of grating  
structures comprised of a plurality of gate stacks;  
generating electrical test data for at least one semiconductor device; and  
correlating at least one of said plurality of optical characteristic traces with said  
5 electrical test data to determine a target optical characteristic trace that  
corresponds to a semiconductor device having at least one desired electrical  
performance characteristic.

12. The method of claim 10, further comprising adjusting at least one parameter of  
at least one process operation to be performed on said provided substrate based upon a  
deviation between said generated trace and said target trace.

13. The method of claim 10, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having at least one  
grating structure formed in a scribe line of said substrate.

14. The method of claim 10, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having at least one  
grating structure formed in a production die formed above said substrate.

15. The method of claim 10, wherein providing a substrate having at least one  
grating structure formed thereabove comprises providing a substrate having a plurality of  
grating structures formed thereabove.

16. The method of claim 10, wherein said grating structure formed above said provided substrate is formed in an area having dimensions of approximately  $100 \times 120 \mu\text{m}$ .

17. The method of claim 10, wherein said at least one desired electrical performance characteristic comprises at least one of a drive current and an operating frequency.

18. A method, comprising:

providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks, said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic;

providing a silicon substrate having at least one grating structure formed thereabove, said formed grating structure comprised of a plurality of gate stacks;

illuminating said at least one grating structure formed above said substrate;

measuring light reflected off of said at least one grating structure formed above said substrate to generate an optical characteristic trace for said formed grating structure;

comparing said generated optical characteristic trace to said target trace; and

adjusting at least one parameter of at least one process operation to be performed on said provided substrate based upon a deviation between said generated trace and said target trace.

19. The method of claim 18, wherein providing a library comprised of at least one target optical characteristic trace of a grating structure comprised of a plurality of gate stacks,

said target trace corresponding to a semiconductor device having at least one desired electrical performance characteristic, comprises:

generating a plurality of optical characteristic traces for a plurality of grating structures comprised of a plurality of gate stacks;

5 generating electrical test data for at least one semiconductor device; and

correlating at least one of said plurality of optical characteristic traces with said electrical test data to determine a target optical characteristic trace that corresponds to a semiconductor device having at least one desired electrical performance characteristic.

20. The method of claim 18, further comprising adjusting at least one parameter of at least one process used to form a gate stack on a subsequently processed wafer based upon said comparison of said generated trace and said target trace.

21. The method of claim 18, wherein providing a substrate having at least one grating structure formed thereabove comprises providing a substrate having at least one grating structure formed in a scribe line of said substrate.

22. The method of claim 18, wherein providing a substrate having at least one grating structure formed thereabove comprises providing a substrate having at least one grating structure formed in a production die formed above said substrate.

23. The method of claim 18, wherein providing a substrate having at least one grating structure formed thereabove comprises providing a substrate having a plurality of grating structures formed thereabove.

24. The method of claim 18, wherein said grating structure formed above said provided substrate is formed in an area having dimensions of approximately  $100 \times 120 \mu\text{m}$ .

5 25. The method of claim 18, wherein said at least one desired electrical performance characteristic comprises at least one of a drive current and an operating frequency.